

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To:

ABB AB LEGAL&  
COMPLIANCE/INTELLECTUAL  
PROPERTY  
721 78 VÄSTERÅS

# PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year)

18-04-2005

Applicant's or agent's file reference

9487WO/CF

**FOR FURTHER ACTION**

See paragraph 2 below

International application No.

PCT/SE2004/002004

International filing date (day/month/year)

22-12-2004

Priority date (day/month/year)

22-12-2003

International Patent Classification (IPC) or both national classification and IPC

B25J 17/02, B25J 19/00

Applicant

ABB AB et al

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further opinions, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

05-07-18

2005-10-22

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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

**PCT/SE2004/002004**

**Box No. I      Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language, \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

- ☐ a sequence listing  
☐ table(s) related to the sequence listing

b. format of material

- ☐ in written format  
☐ in computer readable form

c. time of filing/furnishing

- ☐ contained in the international application as filed.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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**Box No. V** Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-11	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-11	NO
Industrial applicability (IA)	Claims	1-11	YES
	Claims		NO

2. Citations and explanations:

**Reference is made to the following documents:**

D1: EP 1352720 A1  
D2: EP 0648583 A1  
D3: US 4151390 A

The applicant describes the problem of a space saving wrist for a robot arm arranged with hollow for extending power cable. Internal cabling inside wrist house is to avoid any possible damage on the cable and to provide power to a tool. This arrangement becomes complicated with the need of a number of gear combinations, which makes the wrist less flexible because of its size. Therefore, the intention of the applicant is to reduce the size of the wrist by another way of arrangement of the transmission gear and necessary space for internal cabling. The power transmission is provided by a drive-shaft tube arranged symmetrically and coaxially inside each other.

Document D1 discloses a wrist mechanism of arranging space for cables and pipes in a robot arm. A second and a third drive shaft (5, 6) is arranged in an inner space of a hollow in a first drive shaft (4). The second and the third drive shaft transmit rotation to a wrist element (10, 13) around an axis (B2, B3), which are arranged perpendicular to each other. The drive shafts are arranged in different arrangement, e.g. eccentrically, concentrically, coaxially (see figure 2-5). Gear mechanism arranged with the second and third drive shaft transmits driving force to the wrist

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

element (see 0006, 0015 - 0021, 0030 - 0031).

Document D2 discloses a wrist mechanism of an industrial robot in which work for attaching/detaching cable or hose for tool is facilitated. A wrist frame (4) provided with hollow portion (42) is rotated around a second axis (A2), and a tool fixing portion (6) connected to a first bevel gear (5) provided with a hollow form is rotated around a third axis (A3). Reduction mechanism (2, 3), which is respectively driven by two drive motors provided at the end of the arm, is supported at both side surface portions of the front end portion of the arm. Cable and hose connected to tool are provided in the state passed through the hollow portion and the cut portion of the arm, and the hollow portion and the cut portion of the wrist frame and of the first bevel gear (see column 3, line 5 - column 4, line 23; figure 1).

Document D3 discloses a tool holder head for a tool machine movable along two or more axes. The tool holder head comprises inner hollow shafts (52, 78) within an outer hollow shaft (18). The hollow shafts are arranged rotatably and coaxially within each other and supply space for cabling. Each of the hollow shafts is driven by an electric motor (24, 62, 88). Gear mechanism is provided for moving the holder head in three degrees of freedom (see column 1, line 53 - column 2, line 46; figure 1-4).

**Claims 1, 6 and 11**

The invention according to claims 1, 6 and 11 differs from what is known in D1 respectively D2, which is regarded as the most relevant document, in that the first and second drive-shaft for the transmission is arranged symmetrically and coaxially inside each other. This reduces the size of the wrist unit with the capacity of continuous provide of cable.

The problem to be solved is to provide an arrangement of transmitted power from the transmission in a specific geometrical relation, e.g. symmetrically and coaxially. D3 shows a compact wrist unit on tool machines moved in three

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degrees of freedom. The wrist unit shows a geometrical relation of drive-shaft units arranged rotatably and symmetrically coaxially along an axis within each other. The arrangement leaves a space for continuously provide of power from cabling to an attached tool.

The skilled man in the art looking for an alternative way of arranging the relation between several transmissions mechanisms find such in D3. The invention shows an alternative way of relating transmission mechanisms in a compact wrist unit with a channel for cabling. Hence, it is obvious for a man skilled in the art to modify what is known from document D1 respectively D2 with what is known from D3 to solve the same problem as referred to in the claimed invention, as D1-D3 belong to the same technical field. The invention according to claims 1, 6 and 11 does not give any technical effect beyond that expected and thus lacks an inventive step.

**Claims 2-5 and 7-10**

The features of the invention according to claims 2-5 and 7-10 are either disclosed in cited documents or are not considered to go beyond what can be expected from a man skilled in the art. It is considered obvious and of general technical feature for a man skilled in the art to arrange and consider a certain number of drive means, either inside or outside the robot arm, to the wrist unit. Since no unexpected technical effect beyond that expected is achieved, the application is considered obvious and cannot be considered to involve an inventive step. Therefore, the subject matter of these features claimed in claims 2-5 and 7-10 is not considered to involve an inventive step.

The claimed invention is regarded to be industrially applicable.

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawing or on the question whether the claim are fully supported by the description, are made:

The matter for which the invention is sought shall be clear and concise in the term of technical features of the invention.

In claim 1 the reference "symmetrically along the symmetry axis (G)" is not indicated with clarity for the technical feature of the invention. The description does not mention or specify any embodiment of a technical feature related to the claimed axis (G). The interpretation of the reference is referred to the arrangement of the first and second drive shaft in relation to each other. Therefore, the reference shall be clarified and refer to the technical feature for which the invention refers to.

The matter of present claim 6 defines an industrial robot comprising a control system provided by general technical feature of a wrist unit arranged on a robot arm. The claimed invention, as it is presented, refers to a wrist unit with a specific relation of transmission. Therefore, it can be questioned if the invention according to claim 6 indicates the distinctive technical features that are necessary to clearly refer to the matter of the invention, see e.g. claim 1. Therefore, claim 6 shall be more specified to cover the claimed scope. Despite the fact the search and examination has been covered to the technical feature of the invention according to:

A wrist unit provided with hollow for extending internal power cable. The size of the wrist unit is reduced by the arrangement of the transmission gear symmetrically and coaxially inside each other.